



BEET SUGAR INDUSTRY

ITS ADAPTABILITY TO CANADA

FAVORABLE PROSPECTS OF SUCCESS

OBSERVATIONS ADDRESSED TO

Messrs. MICHEL LEFEBVRE & CO.

MONTREAL

Proprietors of the Beet Sugar Factory at Berthierville, Q.

BY

ROBERT H. LAWDER

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MONTREAL, January 28, 1895.

GENTLEMEN,

In the following observations on the Beet Sugar Industry, I have endeavored to show:

The vast extent and importance to which this industry has attained.

The great benefits which have resulted from its operations to the agricultural and commercial interests of the countries in which it has been established in Europe.

The protective policy by which this success has been accomplished.

The adaptability of the soil and climate of Canada to the production of fair crops of sugar beets of good saccharine quality.

The very promising prospects for the successful establishment of this industry in Canada, as demonstrated by the results of three successive years of experiments in sugar beet cultivation in the Province of Ontario, and by this season's experience at your beet sugar factory at Berthierville, in the Province of Quebec.

The necessity of obtaining from the Dominion and Provincial Governments a like measure of protection or aid as that under which the success in Europe was rendered possible of accomplishment.

I remain,

Gentlemen,

Your obedient servant,

ROBERT H. LAWDER.

MESSRS. MICHEL LEFEBVRE & Co.,

Beet Sugar Manufacturers, etc.,

Montreal.

THE BEET SUGAR INDUSTRY.

INTRODUCTORY.

The rapid development and expansion of the beet sugar industry have been remarkable. Not a great many years ago, the world was entirely dependent upon cane-growing countries for its supply of sugar. Now, the greater part of the supply is obtained in beet-producing countries. According to the London *Economist*, the world's production of sugar in 1853 was 1,400,000 tons, of which only 200,000 tons, or one-seventh part, was beet sugar. The *Commercial Record*, London, October 26, 1894, gives the following estimate, by M. Licht, of the world's production for the present and three preceding seasons:—

	1894-95.	1893-94.	1892-93.	1891-92.
Cane sugar, tons....	3,125,000	3,195,436	2,642,327	2,834,302
Beet sugar, tons....	4,675,000	3,895,309	3,416,816	3,501,920
	<u>7,800,000</u>	<u>7,090,745</u>	<u>6,059,143</u>	<u>6,336,222</u>

In the last 40 years, the production of cane sugar increased 1,925,000 tons (or 160 per cent.); the increase in beet sugar was 4,475,000 tons (or twenty-two fold).

In the statement from which the above figures are taken, the different countries in which beet sugar was produced in 1894-95 are not specified; but for 1893-94 the production was distributed as follows:—German Empire, 1,225,000 tons; Austria-Hungary, 800,000 tons; France, 590,000 tons; Russia, 450,000 tons; Belgium, 180,000 tons; Holland, 70,000 tons; the balance from Sweden, etc.

Later estimates of the production of beet sugar in Europe for 1894-95 are much higher than that given above. The production for Germany alone is now estimated at fully 1,700,000 tons, or 25 per cent. more than the whole production of the world in 1853.

During the last 10 years, the skill and experience acquired have resulted in such improvements and economies in the production of both beets and cane, and in the manufacture of sugar, that this

article, which was formerly considered a costly luxury, has now become one of almost universal necessity, and so cheap as to be within the reach of all the industrial classes. The present consumption, either in the United States or in Great Britain, is now larger than the whole world's supply was in 1853. A few years ago, the *London Economist* showed that in Great Britain the wholesale value of the sugar consumed there in 1888 was £16,500,000; whereas, in 1881, the British consumers paid between £20,000,000 and £24,000,000 for 25 per cent. less sugar. The consumption had increased $33\frac{1}{3}$ per cent., while the cost of the increased quantity had decreased about 25 per cent. This is equivalent to a reduction of 56 per cent. in the cost per pound, in seven years.

A few facts specially relating to the history of the beet sugar industry will exhibit the wonderful expansion which it has undergone, and the processes by which this success has been accomplished. In 1830, very few factories were in operation; in 1846, 100 factories had been erected; in 1880, no less than 1,500 beet sugar factories were in operation in Germany, Austria-Hungary, France, Russia, Belgium and Holland. In more recent years, the industry has been established in Denmark, Sweden, Italy and Bosnia in Europe, and in the United States and Canada. Of late years, the tendency has rather been towards the enlargement of capacity than to the increase in the number of factories.

As Germany is the largest beet sugar-producing country in the world, and as its Government has always collected full and reliable statistics relative to every branch of beet cultivation and sugar manufacture, all the information necessary to an intelligent understanding of the industry can be gathered from these records. The cost of the beets delivered at the factories in Germany constitutes fully 70 per cent. of the whole cost of the raw sugar. Hence, the greater part of any reduction in the cost of sugar must be found either in the lower price paid for the beets, or in their improved quality. The statistics show little, if any, reduction in the prices paid for the beets, so that the reduction in cost of the sugar is mainly due to improvement in quality of the beets, although partly to improved methods of sugar manufacture. The Government returns show that in the manufacture of each pound of raw sugar, the quantity of beets worked was: in 1830, 20 pounds; in 1845, 16 pounds; in 1850, 15 pounds; in 1855, 14 pounds; in 1860,

12 $\frac{3}{4}$ pounds; in the six years 1871-72 to 1876-77 11.82 pounds; in the six years 1877-78 to 1882-83, 10.96 pounds; in the six years 1883-84 to 1888-89, 8.66 pounds. The largest yield of sugar was in 1887-88, when only 7.65 pounds of roots were required for each pound of sugar. In 1892-93, 8.35 pounds of beets were required. Since 1845, the economy accomplished through improved quality of the beets and better methods of extraction of the sugar has been so great, that almost double the quantity of sugar is now obtained from the same weight of beets.

Mr. Julius Muth, United States Consul at Magdebourg, in a report to his Government, dated February 17, 1894, furnishes the following information as to the reduction in the cost and price of sugar in Germany, during ten years (the 100 kilos of beets and sugar in his statement are reduced to cwt. of 100 lbs.).

	1882-83.	1892-93.
Average price of sugar, excluding tax, per 100 lbs.	\$4.10	\$2.93
Reduction in price, 28.6 per cent.		
Average price of sugar beets, per 100 lbs.....	0.238	0.226
" cost of manufacturing do. "	0.139	0.079
	<hr/>	<hr/>
	0.377	0.305

Reduction in cost of beets and manufacturing 18.9 per cent.

In 1882-83, 1051 lbs. beets made 100 lbs. raw sugar,
making cost of sugar per 100 lbs..... \$3.96

In 1892-93, 835 lbs. beets made 100 lbs. raw sugar,
making cost of sugar per 100 lbs..... 2.55

It will be observed that, owing to the large number of factories in proportion to the quantity of beets raised, and the consequent competition, there was no material reduction in the price paid to farmers for their roots; but the cost of manufacturing was reduced nearly one-half. This reduction was accomplished mainly by enlargement of the average capacity of the factories, through which means a large saving in operating expenses was effected. It is also seen that at the lower selling price of sugar in 1892-93, a profit of 38 cents per 100 lbs. was realized in comparison with a profit of 14 cents per 100 lbs. on the higher price in 1882-83.

In confirmation of Mr. Muth's statements as to cost of beets and manufacturing, the following figures are given from the *Deutsche*

Zuckerindustrie, showing the results of the operations of 15 standard factories in Germany, for three years : —

	Tons of Beets worked, per campaign.	Cost of Beets per ton.	Cost of Coal per ton of Beets.	Cost of Labor per ton of Beets.	Miscel- laneous per ton of Beets.	Cost of Manu- factur- ing per ton of Beets.
1890-91.	37,450	\$4.91	\$0.55	\$0.48	\$0.91	\$1.94
1891-92.	32,170	4.99	0.51	0.49	0.98	1.98
1892-93.	31,567	5.25	0.50	0.48	0.99	1.97

The cost of manufacturing 100 lbs. of roots as above is about 9 cents as compared with 8 cents in Mr. Muth's statement, and taking 8.35 lbs. beets per one pound of raw sugar, the cost of 100 lbs. sugar is \$2.59 as compared with \$2.55 per Mr. Muth's estimate. The average quantity of beets manufactured in each season in all the factories in Germany, in above years, was 26,000, 23,000 and 24,000 tons per factory, and the average quantity worked per day was 268, 290 and 314 tons; thus indicating a marked tendency towards increase in daily capacity of the factories. In the 15 standard factories above alluded to, only 827 lbs. beets were required to make 100 lbs. raw sugar in the season 1890-91, as compared with average in France for same year, 951 lbs.; and in 1891-92, 821 lbs. were required in the 15 factories, as compared with 876 lbs. in France.

A few figures relating to the imports and exports of sugar into and from Germany will demonstrate, in some measure, what the beet sugar industry has done for that country. In 1871-72 the imports of raw and refined sugar, syrup and molasses amounted to close upon 60,000 tons; the exports of all kinds of sugar were 14,000 tons; the excess of imports over exports being 46,000 tons. The home consumption in 1871-72 was 222,000 tons, and is now estimated at 400,000 tons per annum. Germany's imports of sugar are now practically "nil," and its exports for 1894-95 are estimated as likely to reach 1,300,000 tons. The value of the present season's sugar production, at average prices of last few years, would be over 120 million dollars. It is true that this great success has only been rendered possible by a long continued sacrifice of a considerable portion of the public revenue, which has been distributed among the sugar manufacturers, by way of protection against foreign sugar, and by bonus on all the sugar exported. I

is equally true, however, that this Government aid has enabled the manufacturers to enlarge their business so greatly, that the cost of the sugar has been largely reduced, and an immense industry has been built up in almost every part of the Empire, which has contributed, in a greater degree than any other, to its agricultural and commercial prosperity. The bounty on exports has been reduced to an insignificant rate, and the sugar manufacturers of Germany would be willing that it should be abolished altogether, if France, Austria, Russia and other countries would consent to a like policy.

ADAPTABILITY OF CANADA TO THE BEET SUGAR INDUSTRY.

From the foregoing observations on the results of the operation of this industry in Germany, and from the experience in those portions of the United States and Canada in which it has been established, it is evident that the main question for consideration is as to the adaptation of the soil and climate of Canada for the production of sugar beets of sufficiently good quality, and at such moderate cost, as will enable successful competition with other beet-producing countries.

The Reports of the Departments of Agriculture at Ottawa and Toronto show that, during the years 1889, 1890 and 1891, a large number of experiments were made in the cultivation of sugar beets in different sections of the Province of Ontario. Average samples of the roots were forwarded to the laboratories at the Experimental Farm at Ottawa, and the Ontario College Farm at Guelph, for analysis by the Professors of Chemistry. Among other experiments, the Ontario Agricultural Experimental Farm cultivated one acre of sugar beets in each of these years. In 1889, Mr. C. C. James, the Professor of Chemistry, analyzed and reported on 26 samples obtained from the farm there, and from different parts of the Province; in 1890, he reported on 117 samples. In 1891, his successor, Mr. A. E. Shuttleworth, analyzed and reported on 32 samples. Nearly the whole of the expense of distributing the seed and collecting and analyzing the roots was defrayed from liberal grants of money obtained through Hon. Charles Drury and Hon. John Dryden, the preceding and present Ministers of Agriculture for the Province of

Ontario. Owing to the repeal of the customs duties on sugar and the consequent reduction in price, further efforts, by way of experiments in cultivation, or otherwise, towards the establishment of the industry in Ontario, were suspended.

The seventeenth annual report of the Ontario Agricultural College and Experimental Farm contains a report by Mr. A. E. Shuttleworth, dated December 31st, 1891, in which (see pages 30 to 33) he treats of sugar beets, and gives a summary of all the analyses for the three years; also, a table showing in detail the results of his analysis of all the samples received by him in 1891. The following extracts are taken from this official report:

"In accordance with a letter dated October 20, 1891, a number of blank forms were printed and mailed to parties who grew sugar beets this year. These forms called for information regarding character of soil, cultivation, yield, etc. Each grower filled in a form which was returned to us accompanied by five average beets. As the samples arrived, the green parts on which leaves grew were carefully trimmed off, the beets were then washed clean and allowed to dry. Afterwards, each sample was accurately weighed, and from these weights the average net weight was calculated. Thirty-six samples were received, all in good condition, except two from Walkerville; these, having been unfortunately overlooked in the express office, had wilted.

"The seed of this year's growth was distributed in the spring by the Department of Agriculture, Toronto. It was the same variety as that sent out last year—see Annual Report of 1890, p. 67. The method of analysis was the same as in 1889 and 1890; and the results are given in the same form. The great value of the analysis of this year is that it confirms the results of previous investigation, and enables us to obtain a three years' average.

"The following table gives separately the averages for 1889-90-91, and the average of these three years together.

	No. of samples,	Average weight, lb. oz.	Solids in juice.	Sugar in juice.	Purity of juice.
" Average of results for 1889,	26	2 2	18.95	14.35	75.70
" " " 1890,	117	1 4	17.12	13.58	79.32
" " " 1891,	32	2 2.8	16.76	13.53	80.35
	175	1 13.6	17.61	13.82	78.46

“Following this table is one giving similar averages of the Ontario Experimental Farm product, comparing these averages with the Ontario average in which the Ontario Experimental Farm product is included.

“BEETS GROWN BY THE ONTARIO EXPERIMENTAL FARM.

	No. of samples.	Average weight, lb. oz.	Solids in juice.	Sugar in juice.	Purity of juice.
“Average for 1889,	1	2 1½	21.50	18.00	83.70
“ “ 1890,	1	1 0½	18.03	15.08	83.64
“ “ 1891,	5	1 10.7	18.12	14.94	82.48
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“ for 1889, '90, '91,	7	1 12.9	19.22	16.01	83.27
“ for Ontario, 1891,	2	2.8	16.76	13.53	80.35
“ for Ont. Exp. Farm, 1891,	1	10.7	18.12	14.94	82.48
“ for Ontario, 3 years,	1	13.6	17.61	13.82	78.46
“ for Ont. Exp. Farm, 3 years,	1	12.9	19.22	16.01	83.27

“Great care to observe the proper methods of cultivation was taken on the Ontario Experimental Farm. As a result, the percentage of sugar in juice and purity of juice are much higher than the average throughout Ontario. One cause of this marked difference is the pains taken on the Ontario Experimental Farm to grow the roots entirely under ground, and close enough together.

“The analysis of this year's product sustains the conclusion of former analysis, that the percentage of sugar in Ontario would, under proper cultivation, be as high as in Europe.

“In support of this conclusion, there was a three years' average of 16.01 per cent. sugar in juice, with a purity of 83.27 in the Ontario Experimental Farm product, grown under proper cultivation; and the Ontario average was 13.53 per cent. in 1891, against 13.58 per cent. in 1890, of sugar in juice, with 80.35 in 1891 against 79.32 in 1890, purity.

“In regard to the yield per acre, there is the same difficulty in obtaining reliable data as previously experienced. Calculations from one or two rows are not satisfactory. The Ontario Experimental Farm average of 19.9 tons per acre may be quoted as a possibility. The lower average for the province is due chiefly to non-compliance with some of the conditions of cultivation, indicated by large beets and the great amount of green matter on many of the samples received.

"The following table contains a detailed report of the 32 samples from which the above averages were obtained; and also less reliable data regarding the samples received from Walkerville, Dunnville and Monaghan:

No.	Grower.	Size of plot.	Kind of soil.	When manured.	Date of seeding.	Distance between rows.	Distance between plants.	Date of thinning.
1	G. Strohm, Dunnville ...	1 ac.	Sandy loam..	1891	May	in.	in.	June
2	Rathbun Co., Deseronto..	8 yd.	" " ..	1890	1	20	6	5
3	" " " ..	1 ac.	" " " ..	1891	13	30	8	15
4	R. G. Hicks, Dunnville..	" " ..	Sandy.....	1891	7	30	8	30
5	D. McKinnon, Stratford..	" " ..	Sandy loam..	1890	18	24	8	....
6	S. Furse, Goderich.....	" " ..	Black loam..	1891	20	33	10	30
7	A. Buchanan, Goderich..	" " ..	Sandy loam..	1891	6	33	8	22
8	Wm. Gould, " ..	1 ac.	Mucky.....	1890	10	30	12	1
9	A. C. Huycke, Hastings..	" " ..	Clay loam....	1890	10	18	9	....
10	J. Stephenson, " ..	1 ac.	" " " ..	1890	31	24	6	20
11	S. Beamish, " ..	" " ..	Clay loam....	1890	4	18	6	10
12	G. Coleman, Oshawa....	" " ..	Sandy loam..	1891	23	24	....	....
13	J. Linton, "	" " ..	" " " ..	1891	26	18	8	....
14	W. H. Conant, "	" " ..	Sandy.....	1891	25	30	12	....
15	D. Pickel, "	" " ..	Sandy loam..	1891	22	18	8	....
16	D. Hinkson, "	" " ..	Clay loam....	1891	....	30	12	....
17	L. J. Coryell, "	" " ..	" " " ..	1889	30	24	8	....
18	J. Drope, Harwood.....	" " ..	" " " ..	1890	18	19	10	....
19	W. J. Westington, H'wood	" " ..	" " " ..	1890	20	18	8	....
20	J. Kennedy, Harwood. .	" " ..	" " " ..	1891	20	18	7	....
21	J. Murney, " ..	" " ..	" " " ..	1890	20	18	7	....
22	G. Farr, " ..	1 ac.	" " " ..	1890	15	18	6	....
23	W. McKinlay, Plainville..	" " ..	" " " ..	1890	24	18	8	....
24	Jas. Russell, Cobourg ...	" " ..	Clay.....	1890	15	24	9	....
25	D. Kennedy, Peterboro'..	" " ..	Clay loam..	1890	15	22	9	30
26	" " " ..	" " ..	" " " ..	1890	15	22	9	30
27	Geo. North, Marden	" " ..	" " " ..	1890	18	30	7	25
28	O. E. Farm, Guelph	" " ..	" " " ..	1890	15	20	7	....
29	O.E.F. (Silesian beets) ..	" " ..	" " " ..	1890	23	24	11	30
30	O.E.F. (White French) ..	" " ..	" " " ..	1890	23	24	11	30
31	O. E. F. (German)	" " ..	" " " ..	1890	23	24	11	30
32	O. E. F. (Vilmorin Imp.)	" " ..	" " " ..	1890	23	24	11	30
33	J. W. Taylor, Walkerville	1 ac.	Loam.....	1889	6	30	8	15
34	W. J. Lounsbrough, " ..	" " ..	Sandy loam..	1890	13	30	8	15
35	W. Hamilton, Dunnville..	" " ..	Sand.....	1889	30	18	5	20
36	W. Rutherford, S. Monaghan.....	" " ..	" " " ..	1890	15	24	9	....

amples
relia-
Dunn-

plants.
Date of thinning.
June
6 5
8 15
8 30
8 30
10 30
12 22
12 1
9 20
6 10
8 30
12 30
8 30
12 30
8 30
10 30
8 30
7 30
7 30
6 30
9 30
9 30
9 30
7 25
7 30
11 30
11 30
11 30
8 15
8 15
5 20

No. of hoeing.	No. of scuffling.	Above ground.	Estimated yield per acre.	Average weight of beets.	Analysis of juice.			General appearance, etc.	No.
					Solids.	Sugar.	Purity.		
		in	Tons.	lb. oz.					
3	3	4	48	2 5	17.8	15.78	88.6	Sharply tapering, regular	1
2	2	..	37.4	3 1	19.3	16.38	84.8	Regular, clear, fine	2
2	2	..	22.5	3 8	18.1	16.56	91.4	Short, irregular in shape	3
2	5	..	..	3 0	13.8	9.79	70.9	Short, large and rough	4
2	2	..	..	3 0	16.3	12.60	77.2	Large, regular, little green top, drouthy	5
2	2	..	11.0	2 11	14.3	10.60	74.1	Turnip-shaped, smooth, no green.	6
2	3	..	..	2 1	15.5	13.10	84.5	Regular, affected by drouth and grub.	7
3	2	2	21.0	2 12	15.9	11.40	71.7	Large, irregular, rooty, drouthy.	8
2	3	4	..	2 0	13.6	10.20	75.0	Varying, short, tapering, drouthy	9
2	2	1	6.0	2 9	16.1	12.0	74.5	Some very large	10
4	4	..	20.0	3 5	16.1	12.4	77.0	Very large and green top.	11
4	4	..	15.0	2 14	16.3	13.4	82.2	Rough, rooty	12
4	4	..	14.4	1 1	17.3	14.4	83.2	Tapering, clear skinned	13
2	2	..	14.8	2 7	13.3	8.5	63.9	Short, rough, very green on top.	14
4	4	..	12.0	3 1	19.3	15.7	81.3	Large, turnip-shaped.	15
3	3	2	18.0	2 3	19.3	15.8	81.8	Varied, rooty	16
2	2	1	5.0	2 5	15.9	11.3	71.0	Varied	17
2	2	..	15.6	1 12	14.4	12.2	84.7	Good shape, tough.	18
2	2	..	12.0	1 6	16.9	15.4	91.1	Small, long, pointed, good.	19
2	2	..	12.0	1 9	16.5	14.0	84.8	Regular, some green top.	20
3	4	..	..	2 5	16.9	13.2	78.1	Medium, long, pointed	21
2	2	..	14.4	1 2	19.7	16.3	82.7	Small, clean, good.	22
2	2	..	13.2	1 4	14.4	12.1	84.0	Clear, tough	23
3	3	..	..	2 1	16.0	11.3	70.6	Short, tough, very green in top.	24
2	2	..	14.0	1 14	20.6	17.1	83.0	Rough, rooty	25
2	2	..	14.5	2 8	16.0	13.1	81.8	Varied, smooth	26
2	3	..	6.0	1 5	16 1	13.7	85.0	Dull-skinned, green top.	27
5	..	..	19.02	1 0	16.6	14.2	85.5	Good shape, clear	28
4	5	..	20.6	2 4	16.8	13.6	80.9	Long, even, clear-skinned.	29
4	5	..	16.90	1 7	18.6	15.7	84.4	Small, tapering, rooty.	30
4	5	..	20.7	1 13	18.9	15.3	80.9	Varied, irregular.	31
4	5	..	21.3	1 13	19.7	15.9	80.7	Rough, rooty	32
3	1	..	21.3	1 12	16.1	9.9	61.4	Medium, fair, wilted	33
2	2	1	22.0	1 9	21.4	17.0	79.4	Small, short, wilted	34
2	2	..	40.0	1 8	22.4	18.2	81.2	Small, stubby	35
..	..	..	..	1 14	14.9	10.0	67.7	Regular, very green top.	36

NOTE.—All of the above had been fertilized with farmyard manure with the following exceptions: No. 3 received a mixture of farmyard manure and wood ashes; Nos. 25 and 26 a mixture of farmyard manure, ashes and salt; No. 33 received liquid manure; and Nos. 8 and 34 had never been manured, being on new land.

The above table shows 29 returns as to yield per acre, showing average yield 18.23 tons; 36 returns showing average weight of beets 21.9 lbs.; 17.00 per cent. in solids; 13.55 per cent. in sugar; 80.00 per cent. in purity. In receiving beets at a factory, they are subject to deductions for dirt and trimming for parts unfit for manufacturing. In 1889, when the analysis was taken, account was kept of the gross weight and the trimmed weight, when the tare was found to be a little less than 10 per cent.

Some of the experiments in 1891 were so remarkably successful as to demand special notice, as to suggesting to farmers what can be accomplished in suitable soil and by proper cultivation. Tables Nos. 1, 3, 14, 15, 18, 19, 21, 25, 34 and 35, and the lots grown on the Ontario Experimental Farm, and with an ample supply of such beets, the success of any factory would be assured. In many parts of Europe, the greater profit derived from beet cultivation has been so much more than from any other crop, that too frequent production of beets has impoverished the soil, so that even with the use of expensive fertilizers, a much lower yield per acre is obtained than can be realized in Canada. In 20 years, the highest average yield in Germany in any one year was 34.4 tons per hectare, equal to 11.70 tons per acre. In 1892-93, the average yield was 11.16 tons per acre, and the average price paid for the beets was \$4.97 per ton. The German ton is 2204½ lbs. From the reports submitted to the Ontario Experimental Farm, and from very extensive enquiries made in numerous sections of Ontario on behalf of the Department of Agriculture, there seems to be good reason for assuming that from good soil and under proper cultivation, 15 tons of merchantable beets per acre would be a moderate estimate of average production. Probably the two samples in table of analysis of 1891, Nos. 3 and 34, are the most interesting of the whole, as illustrative of two points. They were both cultivated in much the same manner, 30 inches between the rows, 8 inches between the plants; the average weight of the beets in No. 3, 3 lbs. 8 oz., and in No. 34, 1 lb. 8 oz.; the yield per acre in both cases being nearly the same. It is evident that in No. 3, the beets sent for analysis were larger than the average, and in No. 34, smaller; as in the former case, the yield, if no plants missed maturing, would have been about 45 tons, and in the latter case, 20 tons. The peculiarity of both lots is, that beets of such richness in sugar were produced from rows so widely apart as 30

inches. Lot No. 34, although rich in sugar, was very deficient in purity, which was owing to having been raised on new ground. As to yield per acre, a more correct judgment is obtained from the results at the Ontario Experimental Farm. The only other case in which the product of an acre of beets was ascertained by weighing the entire crop, was in that of Mr. Thomas B. Carlaw, Township of Percy, who, in 1890, raised an acre of sugar beets from same seed as was distributed in 1890 and 1891. The seed was sown on 10th May, the roots lifted on 30th October, the soil, a light clay loam, manured in May with 15 tons barnyard manure; the seed was sown in rows 18 inches apart, the plants thinned out to 9 inches apart, the ground was hoed 4 times, and the roots kept well under ground. Twenty-five average roots weighed $34\frac{1}{2}$ lbs., and the whole crop weighed 26 tons, 14 cwt. Very few of the plants missed. The percentage of sugar was 15.17, purity 83.63. This was a wonderful success, considering that the land was manured in same season that the seed was sown. Mr. Carlaw is confident that this yield can be attained by proper cultivation on good soil, and that by manuring a year before sowing, and proper preparation of the ground, the quality of the roots can be improved. Farmers may form a reliable estimate of probable yield per acre by the following rule: take a plot of one acre 8 rods by 20 rods. Make the rows 2 feet apart, and thin out the plants to 9 inches apart, this would give 29,000 plants per acre, and if average weight of each root $1\frac{1}{2}$ lbs., this would give over $21\frac{1}{2}$ tons per acre. Allowing for plants that may miss, or be unmerchantable, 15 tons per acre appears to be a reliable yield.

The above table and statements show conclusively that the soil and climate of Ontario are admirably adapted for the production of sugar beets of superior quality, and that in all the sections of the province, where experiments in cultivation have been made, the success has been very encouraging.

COST OF CULTIVATING SUGAR BEETS.

Numerous enquiries have produced many estimates. The following was obtained from two of the best farmers in Ontario, who have had extensive experience in root crops: rent and taxes per acre, \$5.00; fall and spring ploughing, \$5.00; harrowing and rolling, \$3.00; dibbling and thinning, \$6.00; scuffling, \$2.00; manure,

\$5.00; in all, \$26.00. Mr. Carlaw, above referred to, kept an account of all the cost on the acre which he cultivated: rent and taxes \$3.31; manure, \$6.00; twice ploughing, \$4.00; harrowing 4 times, \$2.00; rolling, 20c.; hoeing and thinning \$4.50; scuffling 3 times, \$1.50; in all, \$21.51. To the above is to be added cost of harvesting and topping and teaming to the factory. These estimates do not vary much from one made by the Bureau of Industries for growing and marketing an acre of turnips, \$35.48, which includes \$9.30 for marketing.

The objection frequently urged against the cultivation of sugar beets in Canada at prices to compete with Europe is the comparatively high cost of labor here. This, however, is more than counterbalanced by the relative cheapness of land or low rate of rent in Canada. As this is an important point, a comparison with some of the costs in Europe is necessary. Mr. John Wilson, United States Consul at Brussels, in a Report dated February 15, 1884, gives the following estimate of the general cost in the Duchy of Brunswick, which he says is as well adapted to this purpose as any other, in all the conditions of price of land, soil, climate and cost of labor. Rent paid to proprietor, 150 francs; seed and preparation of the soil, 140 francs; plowing, harrowing and other cultivation, 183 francs; artificial fertilizers, 150 francs; total, 623 francs per hectare (about $2\frac{1}{2}$ acres). This is equal to \$48 per acre. The rent of the land and the cost of fertilizers is \$23.20 per acre. The average yield per hectare is given as 28 German tons per hectare, or little over 11 tons per acre.

In Ware's book on "Beets and Beet Sugar," he gives two estimates of the cost of producing beets in France. According to Payen, a recognized authority, although his experience was that of many years ago, the cost per hectare was: rent, taxes and interest, \$23.00; manures, \$26.00; plowing and harrowing, \$17.20; sowing, \$3.60; weeding and hoeing, \$7.00; gathering and transportation, \$7.20; total, \$84.00, or \$34.00 per acre. Mr. Ware visited several beet farms in the north of France, principally in the arrondissement of Cambrai, and found the average cost \$27.93 per acre. Mr. Ware shows that the average value of beet land in Belgium is equal to \$313.77 per acre. In Bohemia, beet land near the factories is worth \$500 to \$600 per acre. These statements are sufficient to show that the higher rent of land in Europe used for beet cultivation is

more than an offset to the dearer labor in Canada. In addition to this, the beet growers of Europe have to expend large amounts for artificial fertilizers on their exhausted lands, from which expenditures the Canadian farmers will be exempt.

From all of the above statements, it appears that the yield of beets in Canada has averaged larger than that realized in Europe; that where proper care has been taken in cultivation, the quality of the beets compares favorably with those of Europe; and that, all things considered, the cost of production in Canada is less than in Europe. One of the strongest considerations in favor of beet cultivation in Canada is the fact, that if European farmers find this crop the most profitable one which they can raise, with prices for grain and cattle there from 30 to 50 per cent. higher than here, then by just so much proportion should Canadian farmers find beet cultivation here more profitable than other crops, if same prices obtained for beets here as in Europe.

MISTAKEN IDEAS ABOUT BEET SUGAR.

There is a very general prejudice against beet sugar, owing to the impression that it is inferior in quality and sweetness to cane sugar. The highest chemical authorities in Europe, after testing thoroughly refined sugar from cane and beet, pronounce the two descriptions as identical and indistinguishable from each other. Any defect in either is owing to mistakes or neglect in refining.

Another mistaken idea is as to the relative percentage of sugar contained in the cane or in the beet, and as to quantity of sugar obtained from an acre of cane or an acre of sugar beets.

The Report of the Commissioner of Internal Revenue of the United States for the fiscal year ended June 30th, 1894, shows the following comparison between the cane-producing State of Louisiana and the sugar-beet producing State of California, for that year:—

Louisiana	sugar per ton of cane used	pounds	144.5
California	" " beets used	"	260.0
Louisiana	" per acre of cane	"	2914.0
California	" " beets	"	2838.5

Nearly double the weight of cane was required in Louisiana to produce the same quantity of sugar as was required in California for producing sugar from beets.

BEET SUGAR OPERATIONS IN THE PROVINCE OF QUEBEC.

In discussing the questions of sugar beet cultivation and beet sugar manufacture in Canada, and the prospects of the successful establishment of the industry in this country, it is necessary that reference should be made to the results of the experiments which have been made in the Province of Quebec. It is generally known that, several years ago, beet sugar factories were erected at Farnham, Coaticook and Berthierville. The buildings were substantial and of ample dimensions; the machinery was of the best type and quality then manufactured, and the promoters of the industry felt sanguine as to success. The history of these factories has, until the present season, proved a continuous record of disappointment and loss. Ill-judged location of the works, mismanagement and lack of experience, absence of sufficient capital to continue operations until early difficulties should be overcome, were some of the causes of these failures. The most important cause of all was the premature erection of the works, before a sufficiently extensive range of experiments had been made in the cultivation of beets to educate farmers into a state of preparation for growing this crop on the extensive scale and with the necessary skill to meet the requirements of the factories as to quantity and quality. In fact, all the other difficulties were such as might have been easily overcome, but the difficulty as to insufficient supply and unsatisfactory quality of a large proportion of the roots appeared to be insuperable, and the prosecution of the industry was generally abandoned.

The only beet sugar factory now in operation in Canada is located at Berthierville, in the Province of Quebec. This factory was operated in 1893-94 by Messrs. Michel Lefebvre & Co., of Montreal, and is again being operated by them in 1894-95. In the former year, notwithstanding liberal inducements offered to farmers, the supply of beets obtained was insufficient to keep the works employed for half of their capacity, and the serious operations resulted in considerable loss. Undeterred by their first year's experience, and encouraged by the increasing disposition of farmers to engage more extensively in the cultivation of sugar beets, the proprietors of the factory, in the spring of 1894, renewed their former liberal inducements to farmers, and have succeeded in obtaining

for campaign of 1894-95, an ample supply of roots for the full capacity of the works. There has also been such improvement in the quality of beets, that the season's operations are likely to result in a small profit, even under present very low prices for sugar. One of the most serious doubts as to the success of the beet sugar industry in Canada has been as to the willingness of Canadian farmers to undertake the cultivation of beets on a scale sufficiently extensive for the supply of the large factories which are required for the economical manufacture of sugar. The success of this season at Berthierville has conclusively settled this point. Not only are the farmers in that section anxious to continue cultivation on last season's scale, but they are eager to extend their operations. With the assurance of an ample supply of beets, and with a confident reliance upon an annual improvement in their quality, Messrs. Michel Lefebvre & Co. are prepared to undertake new and more extensive operations, so soon as Parliament shall afford to the beet sugar industry in Canada a like measure of protection or assistance as has been granted to the iron and other manufacturing industries. They claim, that inasmuch as fully 60 per cent. of the cost of their output of sugar consists of money paid to farmers for their beets, this industry is, to an exceptional extent, a farmer's industry; that, owing to the agricultural depression caused by the low prices of grain and almost all other farm products, the beet sugar industry should command the special consideration of Parliament, as being eminently adapted to relieve that depression, and to promote the prosperity of the most numerous and important branch of the community.

It may be here noted that the present proprietors of the Berthierville factory, by securing an ample supply of beets, have succeeded in doing in two years what United States beet sugar factories have failed to accomplish after many years of operation.

LOCATION FOR BEET SUGAR FACTORIES.

In determining as to the location of factories, a great many considerations are to be taken into account. For a factory with a capacity for working 400 to 500 tons of beets per day of 24 hours:

1. There must be an unfailing supply of suitable water of at least two million gallons in every day of 24 hours.

2. There should be at least 20 acres of land, for erection of factory and outbuildings, and for yard room for storage of beets and refuse from factory, and for railway sidings.

3. There must be excellent railway facilities for receiving and shipping all the materials, beets, coal, limestone, coke, etc., and for shipping from the factory all the sugar, pulp, etc., produced there. Convenience for transportation by water would be an additional advantage. As the factory would probably derive its supply of beets from 8 or 10 sections of country, it will be desirable that at least as many railway stations should lie within such moderate distance from the factory as will ensure cheap railway transportation.

4. There must be good drainage facilities for carrying off the large quantity of waste or used water, etc., from the works. An outlet into a lake or swift flowing large stream would be an advantage.

5. Cheap coal, limestone and coke are also considerations, as these three items constitute a large proportion of the cost of manufacture.

While all the above considerations are of some importance, the great consideration to be kept in view in the selection of a location for a beet sugar factory is as to the section of the country which affords the best assurance of an ample supply of beets, of good quality, and at moderate prices.

DESIRABLE CAPACITY OF FACTORY.

All late experience, both in Europe and in the United States, shows a decided tendency towards the enlargement of the daily capacity of beet sugar factories. The saving in relative cost of construction and operation is very great, so much so, that large factories are found to realize fair profits in seasons where the smaller factories sustain heavy losses, although the conditions as to quality and prices of beets and materials are alike in both instances. During the past 25 years, the increase in the number of factories in Germany has been about 30 per cent., while the increase in the production of sugar has been about 500 per cent. In Cali-

fornia, one or two of the factories, originally of 300 tons capacity, have been enlarged to 1,000 tons of daily capacity. All the United States consuls in Europe who refer to this phase of the industry emphasize the desirableness of large factories. The larger the better. The only limit is the quantity of beets which the factory can obtain from the section of country upon which it can depend for its supply of roots. As there are numerous localities in Canada possessing all the necessary requirements for cultivation of good sugar beets and for the manufacture of beet sugar, it will prove poor economy, and will probably entail serious loss to the promoters, if they should attempt operations with any factory having a capacity for working less than 400 or 500 tons of beets in 24 hours. A few figures will conclusively establish the superiority of large factories.

In a collection of special United States Consular Reports on "The Beet Sugar Industry," published at Washington in 1891, there is found, on pages 408 to 411, an estimate and specification in detail, from a sugar works manufacturing firm in Brunswick, for all the machinery required in a beet sugar factory of 100 tons daily capacity, total cost \$59,590, and for a factory, 500 tons daily capacity, \$142,000.

This shows that, by the additional expenditure on machinery of 138 per cent., a gain of 400 per cent. is obtained in working capacity. Although not in as large proportion, there will be a further saving of cost in buildings. Taking the interest on capital, fire insurance, repairs, wear and tear of buildings and machinery, it is obvious that the annual charges on these items will be vastly larger in proportion to the sugar manufactured in the case of the smaller factory than in the larger. In both cases, a large amount of skilled labor will be required, and here again the relative proportion of cost to material manufactured tells greatly against the smaller factory. An expert's estimate of the working of a 200 and 500 ton factory on the same quality and price of beets, and for the same number of days in the season, shows excess of cost of refined sugar $\frac{1}{2}$ cent per pound in the small factory over that in the larger. In 1874-75, the average quantity of beets manufactured in Germany per factory in each 24 hours was 39.4 tons; in 1893-94, 168.2 tons, or about $4\frac{1}{2}$ times greater.

EXTENT OF MARKET FOR SUGAR IN CANADA.

The normal consumption of sugar in Canada may be fairly stated at 150,000 tons, with the probabilities of a steady annual increase. To produce this quantity of sugar, 30 large beet sugar factories would be kept in employment, consuming about 1,500,000 tons of beets and giving employment to many thousands of operatives.

IMPORTANT BENEFITS TO THE DOMINION IN GENERAL.

Farmers.—Every factory of 500 tons capacity would require fully 3,500 acres of land to be brought under beet cultivation. From the sale of the crop of roots, the farmer would obtain a larger sum per acre, after paying all costs of cultivation, than he can obtain for any other crop including the cost of cultivation. From the culled beets he will obtain a large supply of food for cattle. From the leaves and necks, he will obtain a great deal of valuable manure. From the purchase of pulp at the factory, he will secure a supply of nutritious cattle feed of as valuable quality as the general run of root crops, and at a much lower cost than he can possibly produce the same. Every acre of land cultivated with beets will be greatly improved in condition, and will produce larger crops and of better quality than formerly. The American consuls in different countries in Europe all testify that in those sections where beet production has been most extensive and successful, there has been a large increase in the quantity of grain raised and of cattle fattened.

Builders, Mechanics, Machinists and Laborers.—Each such factory will cost about \$400,000, the whole of which, except the technical parts of the machinery, will be of Canadian workmanship. In addition to this, every factory will largely increase the population of the town or village where located, and will necessitate the erection of a great many dwelling houses for occupation by the artisans employed at the sugar works.

Lumbermen and Miners.—The factory buildings and houses of its employees will create a large market for all kinds of lumber and timber. The works will also consume annually about 8,000 tons of coal, 4,000 tons of limestone, and 500 tons of coke, and will thus contribute materially to the prosperity of these industries.

Agricultural Implement Makers.—As the proper system of beet cultivation becomes to be fully understood, a demand will be created for new styles of plows, seeders, cultivators and harvesters specially adapted to this branch of agriculture.

Railway and Transportation Companies.—Each such factory will require, annually, transportation facilities for fully 60,000 tons of material to and from the works.

General Commerce.—The manufacture of 150,000 tons of sugar from Canadian beets would imply an annual expenditure of about \$12,000,000. As this industry would form an additional source of income to the farm, and would rather add to than detract from its other productiveness, and as it would furnish a great deal of new employment to thousands of operatives, and much additional work for existing industries, it is difficult to over-estimate the stimulus which it would impart to the general commercial and financial prosperity of the Dominion.

NECESSITY OF PROTECTION OR BONUS.

If in almost every part of Canada there are large sections of country admirably adapted to the successful cultivation of sugar beets, and if the circumstances and conditions of Canadian farmers are such that beet production should afford them relatively better returns for this crop compared with grain or other crops than is the case in Europe, if they should receive European prices for their beets, and if the cost of the beets forms the greater part of the cost of the sugar, it may seem strange that protection or a bonus should be necessary to the establishment and extension of the industry. It is frankly admitted that if a large beet sugar factory, well equipped with the best approved modern machinery, could be located at some suitable point in Canada, where the company could purchase its full season's supply of beets of a quality equal to the choice lots grown on the Guelph farm and in a few other places, at the same prices that are paid in Europe for like qualities, then, under such circumstances, very little protection would be required, and this only until the same skill in extracting and manufacturing sugar should be attained here as in Europe. Plausible as this theory may seem, the history of the sugar trade, both in beet and cane, has shown that in the early establishment of both the agricul-

tural and manufacturing branches of the industry, many difficulties and drawbacks are encountered which were quite unexpected. The experiments which have been made in Ontario were generally entrusted to select farmers on good farms. The results, although very promising on the whole, show some sorry failures, partly owing to unfavorable soil, and largely owing to neglect of farmers to follow the rules for cultivation which they had been asked to comply with. In order to obtain the necessary supply of beets for the season's operations of the factory, Canadian companies will be compelled for the first few seasons to offer farmers special inducements for extensive cultivation. One of the usual inducements offered by new factories is an agreement to accept all the beets offered at a stated price per standard for quality, with advance or decrease for superior or inferior quality. Even with this graduating scale of prices, the companies find themselves compelled to accept many lots of beets at prices far above their respective value. Although Canadian companies will have the advantage of the lessons derived from over 40 years of sugar beet cultivation, they will have much to learn as to the adaptation of certain favorite varieties of seed to different soils, and the most favorable time for sowing; and they will find here or elsewhere much difficulty in inducing farmers to follow the different system required for sugar beet cultivation to that which they have followed for ordinary field beets. It will take some years for Canadian farmers to discover which of their fields is best adapted to this crop, and to get these fields under that deep cultivation which is so essential to the best results. Another important difficulty is in the preservation of the beets from the effects of heating or freezing. At best, the season during which beets can be profitably manufactured is very short, probably about four months, from October 1 to January 31, or 100 working days. All beets, however carefully preserved, lose part of their saccharine qualities every month after harvest. An interesting experiment was made at the Guelph Experimental Farm in 1890 for testing this tendency. The crop of that year was pitted immediately after being harvested, and was allowed to remain in the pit until March 12. When then opened, the roots were found to be generally in a good state of preservation, but an analysis of their quality showed a depreciation of 2 per cent. in their sugar proportion since similar analysis at harvest time. This showed a serious

reduction of a little over one-seventh part of their original value. The difficulties to be overcome are not confined to beet production and preservation, but will be met with in the operations at the factory. However excellent the machinery employed may be, it is to be expected that during the first season, at any rate, some stoppages or breakdowns will occur which will cause much delay and expense. So also in the extraction of the juice of the beets and in the different processes of its manufacture into sugar, the very best skill and experience that can be secured will meet with many difficulties owing to peculiarities in the difference of the juice from that with which they have been accustomed to deal. It is a well established fact that United States beet sugar factories are now able to obtain fully 1 per cent. more sugar from the same quality of beets than they were able to obtain five years ago. The same experience may be expected in Canada.

No beet sugar industry has ever succeeded anywhere, except by means of Government protection or bonus, and in most countries by both. In Germany, the import duty on foreign sugar is now 30 marks per 100 kilos, equal to \$3.25 per 100 lbs. Previously, this duty was only for sugars up to No. 19 D.S. ; other raw sugars paid 24 marks (\$2.60 per 100 lbs.).

In Austria-Hungary, the import duty on raw sugar under Holland standard No. 19 is 15 florins per 100 kilos, equal to \$2.62 per 100 lbs. ; on raw sugar above No. 19, \$3.50 per 100 lbs. ; and on refined sugar, \$3.50.

In France, in 1887, the import duty on brown sugar estimated to produce when refined 98° or less was equal to \$2.00 per 100 lbs., and on higher grades of raw and on refined sugars \$2.50 per 100 lbs.

In Belgium, Netherlands, Denmark and Sweden, the import duties were higher than the above rates.

It is seen that the beet sugar industry in these countries was fostered by such high import duties, that it was protected in the home market from all foreign competition. Thus ensured of the full control of the home market, the industry succeeded so rapidly, that in a very short period, the chief countries of continental Europe, instead of remaining, as formerly, importers of cane sugar, became large exporters of beet sugar. The benefits which these countries derived from the expansion of the beet sugar were so numerous and important, that in order to maintain the rate of production attained, and

if possible to still further extend it, the different governments granted to the manufacturers bounties or bonuses on all the sugar exported. It was contended in favor of this policy, that it was necessary to the success of the industry, and was really not prejudicial to the other industries of the country, because the larger the factories and the greater the production of sugar, the lower the cost of the article, so that the reduction in the price paid by the home consumer was fully equivalent to the amount of bonus or bounty paid to the exporting manufacturer.

In Germany, the profits obtained by the sugar manufacturers and refiners in many seasons were so enormous, that public opinion demanded a material reduction of the export bounties, and by an Act which came into force on Aug. 1, 1892, these bounties were largely reduced, and fixed for the three succeeding years at equal to $13\frac{1}{2}$ cents per 100 lbs. for raw and refined sugars from 90 to 98 purity ; and 21.64 cents per 100 lbs. on refined sugars of at least $99\frac{1}{4}$ per cent purity ; and 17.40 cents per 100 lbs. on all other sugars ; and for the two succeeding years up to July 31, 1897, the rates were further reduced to 10.80 cents, 18.94 cents and 15.15 cents respectively, on the different grades. The Act further provided that after July 31, 1897, bounties on exports should cease altogether. It has been a common argument of those who have no confidence in the success of the beet sugar industry, that the success achieved in Germany, etc., was wholly attributable to what they have termed the enormous and unfair export bounties. It must be difficult for them to reconcile this contention with the fact that, since the reduction of the bounties in Germany to the almost nominal sums above quoted, the beet sugar industry in that country has expanded during the last three years in a much greater proportion than in any previous period of its history. To those who have faith in the early success of this industry in Canada, the experience of Germany is full of encouragement. Twenty years ago Germany was a large importer of foreign sugar ; now, although the domestic consumption has doubled in quantity, that Empire expects to import during 1894-95, about 1,300,000 tons of sugar. The capital invested in the beet sugar manufacturing industry is about \$80,000.00, and the value of the annual output for this season is estimated at about \$125,000.00. Mr. Albert H. Washburn, United States Commercial Agent at Magdebourg, in a report dated December 27, 1890, referring to the

success of the industry in Germany, says :—"Two things have contributed to Germany's present ascendancy in the production and exportation of raw beet sugar. The first is the superiority of soil and climate for the growing of the beet root ; the second is the peculiar encouragement given the industry itself by the Government."

Equally instructive are the results in Austria-Hungary. During the five years 1849-1854, the average annual imports of foreign sugar amounted to 787,478 cwt. (Vienna cwt. equal 123.46 lbs.) During the season 1893-94, Austria exported 800,000 tons of domestic sugars. Similar illustrations of the effects of the protective policy on sugar might be given from the results in France, Russia, etc. It may be that, in order to accomplish such results, the governments of these countries have had to sacrifice considerable revenue, and the consumers have had to submit to high prices for their sugar ; but nowhere is there heard any complaint that the sacrifice so endured has not been fully compensated by the general benefits which have resulted. Of late years, there has been an agitation for the repeal or reduction of the bounties on exports, arising from the conviction that the bounty system is no longer necessary to the maintenance of the industry.

All the conditions for the success of the beet sugar industry in Canada are much more favorable than they were in any country in Europe, when the industry was first established, so that the same high protection against foreign sugar will not be necessary, nor will there be any necessity for a long continuance of any protection. In embarking in this industry, Canada has the advantage of at once deriving the benefit of all the experience which Europe has acquired from the many costly experiments of over 50 years, in the improvement of seed, cultivation of the crop and methods of manufacturing the sugar. Still, much of the work for several years will be largely of an experimental character, and many errors in cultivation and manufacture will unquestionably occur, which will entail great risk during the early years of the industry. All the manufacturing industries of Canada are protected by heavy import duties on foreign goods, and in the case of iron, that industry is further aided by liberal bonuses from the Dominion Government and that of the Province of Ontario. In the case of sugar, it has been considered advisable, in the interest of the consumers, that this article of universal use and necessity should be admitted free of duty. Under

a continuance of this policy, capital cannot be expected to be invested in the beet sugar industry, except by the extension of the same bonus system as has been established for the iron industry. If a bonus on iron is considered necessary and judicious in the general interest of the Dominion, and for the benefit of the comparatively few who are interested in that industry, with what propriety can a similar bonus be refused for the promotion of the beet sugar industry, the advantages of which will be distributed so generally, and especially among farmers whose present position demands the utmost care and consideration?

It may be suggested that the bonus to be granted to the beet sugar industry should extend for ten years. For the season 1895-96, it should remain as at present, as the manufacturers have made their arrangements with farmers for the delivery and payment of beets at former prices. As the first few years of operation are the critical years for beet sugar factories, owing to the initial difficulties in establishing the industry, a very liberal bonus for the first year will be necessary, in order to induce capitalists to invest the sums required for large, well equipped factories, none of which could be ready for operation until the beet crop of 1896 can be secured. In each of the five succeeding years, the bonus established for 1896-97 might be subject to a reduction of 10 per cent., so that in the year 1901-1902, the rate of bonus would have been reduced one-half, at which it might remain for the following four years.

It may be contended that under proposed bonus system, the demand on the revenue of the Dominion might become enormous, if the production of beet sugar in Canada should expand so rapidly as to constitute any large proportion of its consumption. It is not at all likely that many beet sugar factories will be erected until the results of the operations of the first two or three factories shall have been ascertained. If these results should prove so favorable as to show that the amount of bonus granted is larger than is necessary for the extension of the industry, the Act can be amended by reducing the bonus to be granted to future factories by such proportion as experience may have shown to be necessary and judicious. If the results should, on the other hand, prove unfavorable, no more factories will be built, and there will be no serious drain on the country's revenue.

APPENDIX.

UNITED STATES CONSULS SATISFIED AS TO THE ADAPTATION OF THE
SOIL AND CLIMATE OF THE NORTHERN STATES FOR SUGAR BEETS.

They all agree that the soil on which good crops of wheat can be raised, and soil in which grapes and apples succeed, are adapted to sugar beets. Any section in which the maple yields much sugar is likely to produce good beets. As to climate, the sugar beet requires warmth and light and a certain amount of moisture during the first period of vegetation; warmth and moisture for production of roots and leaves during second period; and dry, warm weather for saccharification during last stage of maturity.

Commercial Agent Hawes, in a report dated Reichenberg, November 8, 1889, says: "Why should one pay out yearly \$80,000,000 for an article that we can easily produce ourselves? Clearly, our efforts should be directed to the development and protection of such an industry until we may be able to save the enormous sum now paid to foreign countries, if not eventually to supply those countries themselves with sugar."

Consul Potter of Stuttgart, in a report dated November 1, 1879, says: "Highly intelligent experts in the beet-root sugar industry of Germany, who have carefully studied the climate and soil of America, do not hesitate to express the opinion that in a few decades the United States will supply their own enormous sugar demand, chiefly from the beet. Taking as a basis of judgment the facts developed by the beet-sugar production of Europe, the climate of the New England States, the vicinity of the Great Lakes, and in the same direction or zone westward, would appear to be the localities most favorable for the production and culture of the sugar beet. The enormous advantages of sugar-beet planting to the agriculture of a country having a domain so extensive as that of the United States cannot be estimated too highly. No industry could probably be introduced that would more rapidly add to the wealth of the country."

Consul Keifer, of Stettin, in a report dated February 2, 1884, says, after referring to the progress in Germany: "If I look at these astonishing results, I cannot help thinking that, in the cultivation of this root, a new and large field of enterprise and prosperity would

be given to our American people. Climate and soil in many States, as, for instance, in Michigan, Wisconsin, Iowa and Minnesota, are particularly fitted for the culture of sugar beet. The time will come when the beet root will be for the North what the sugar cane is for the South, and sugar factories replace within the Northern States the cotton mills now springing up in the South, and the wealth of the nation will be increased materially, not only by adding a new industry to the country, but also by saving hundreds of thousands of dollars now annually sent abroad."

Consul Merritt, of Chemnitz, in a report dated October 25, 1890, says: "There are within the United States, lying between the thirty-eighth and forty-second degrees of latitude, a great many millions of acres of land which are as thoroughly adapted to the culture of the sugar beet as any land on earth. It does not appear proper or consistent that an agricultural country like the United States should be dependent for any article of purely agricultural character on foreign countries, especially when the United States has fully one hundred times as much land adapted to the production of that article as is available in the country from whence the article comes."

All of the above suggestions apply to Canada as fully as to the United States.

EXTRACT FROM THE *American Economist*, NEW YORK,
MAY 3, 1889.

"This journal has, from the beginning, been a persistent advocate for ample protection for the manufacture of sugar. It believes that the natural resources of this country are adequate for the production of all the sugar required; that with proper encouragement the production of American sugar would soon be ample for the demands of the American people, and thereby the country would be saved an annual payment to foreign nations, for this necessary article of food, amounting to \$50,000,000 to \$75,000,000. It has been persistently claimed that when the manufacture should be thoroughly introduced and the effect of active competition be felt among producers, the prices of sugar made at home would reach as low a level as they have ever reached in foreign countries, and by this the consumers of sugar would be saved at least the whole amount of duties now annually paid on the importations of sugar,

amounting to \$50,000,000 annually. In support of these views, we have, from time to time, given such evidence as was afforded by Government experimental stations in different parts of the country for the manufacture of sugar, and such further information as could be procured from private sources."

FARMERS AS PROPRIETORS OF OR SHAREHOLDERS IN BEET SUGAR FACTORIES.

In Russia and Bohemia, most of the beet sugar factories are owned by the large land-owners, who raise their own beets.

In Germany, in 1892-93, the total quantity of beets manufactured was 9,811,940 tons, of which 1,510,835 tons were grown by the owners of the factories, 3,302,740 tons were grown by stockholders in the companies, under contract, and 4,997,365 tons were grown by outsiders, these last forming 50.94 per cent. of the whole supply.

The following extracts from reports of United States Consuls in Europe refer to some of the usages in Germany:—

Consul Millar, report dated Leipsic, July 21, 1887, says: "The manufacturer of raw sugar is generally a farmer also, and cultivates large areas of ground."

Consul Bullock, in report dated Cologne, June 1, 1891, says: "This industry is becoming more purely agricultural from year to year,—that is, it is no longer the large-landed proprietors and capitalists who alone erect and operate sugar factories, but the small land-owners and even the peasants unite and build factories for the manufacture of sugar from the beets raised in the neighborhood."

Consul Wilson, in report dated Brussels, February 15, 1884, says: "There is still another feature of this manufacture in Germany that accrues to the benefit of both cultivator and refiner, and worthy of consideration. A very considerable number of the refineries in that country are now organized and incorporated as co-operative companies. In other words, the large and small cultivators of the beet in certain districts have built refineries upon the following joint-stock plan:—After determining the probable cost of their contemplated refineries, shares of stock are issued, payable in instalments, to cover the expense incurred, and each stockholder obligates himself to furnish to the refinery an annual quantity of beets

proportioned to the stock he has in the concern ; and as every stock holder, whether large or small, is dependent upon the product of the refinery for quite a portion of the profits of his cultivation, he leaves nothing undone in the way of cultivation to bring his beet crop up to the highest possible standard of both quantity and quality. Indeed, there can be but little doubt that this class of sugar manufacturing has done more to perfect the beet culture in Germany than any one other element whatever."

Consul Kiefer, in report dated Stettin, February 2, 1884, gives the following statement as to the establishment of a factory at that place : " Towards the close of last year, the project of establishing such a factory near Stettin was discussed, and the preliminaries all having been fulfilled, the organization of the company, Zucherfabrik Schenne, took place on January 28 of this year, in this city."

According to the statutes, the capital stock will consist of 900 shares of 500 marks each (about \$120), making a total of 450,000 marks (\$108,000), with power to the board of directors to increase the capital to 750,000 marks (\$180,000).

The shares are either beet root shares, so-called, or cash shares

There are 614 of the first kind.....Marks 307,000

" " 286 " " second " " 143,000

All the shares having been subscribed for, and 10 per cent. as first payment has already been paid in, only 10 per cent. more besides the first payment will be asked in cash of the so-called beet shares, the balance of 80 per cent. will be compensated by a deduction of 20 pfennigs per centner of the roots to be delivered. By this very ingenious plan, the company, as will be seen at once, secures at the same time capital and raw material at a reasonable price, for running the factory.

The business of the company is to be managed by a board of directors and a board of trustees and the general meeting of the shareholders.

Each director must hold at least 30,000 marks in shares, which he has to deposit with the trustees as surety.

The total expenses for putting in running order are estimated at 797,937 marks (\$189,500), equalized by an income of 750,000 marks on shares, and a mortgage to be given for 200,000 marks, leaving 152,063 marks for carrying on the business.

PLAN RECOMMENDED FOR AMERICAN FARMERS.

Consul Merritt, in report dated Chemnitz, October 25, 1890, says: "It would not be difficult to enter upon this industry at once. In order that all interested might share in the undoubted prosperity which would follow, the plan here submitted is modestly offered. A stock company, with a capital stock of \$250,000 in 2500 shares of \$100 each, could be organized. Three-fifths of the shares could be made 'beet shares,' and two-fifths cash shares. Ten or twenty per cent. of the beet shares could be paid in cash, and the balance might be gradually deducted from the money due the shareholders for the beets delivered by them to the factory. The cash shares could be paid for in such manner as determined upon. The management of the concern is to be determined upon by the shareholders. This plan has been found to work with unqualified success in Germany, where many factories are in operation on this basis."

Mr. John B. Hawes, U. S. Commercial Agent, Reichenberg, Austria, Hungary, in a report dated November 8, 1889, presents some "Hints to American Farmers," submitted to him by Professor Veith, Director of the Agricultural College at Reichenberg, in which he says: "A better plan would be for a number of farmers to form an association and erect a factory themselves. We find such associations in Germany, and they do very well. In closing, I would only state that there exists a great future for beet culture in the United States."

PROFITS OF SUGAR BEET CULTIVATION.

COMPARISON WITH GRAIN CROPS.

Mr. John Wilson, United States Consul in Belgium, in a report dated Brussels, February 15, 1884, devotes a paragraph illustrative of this point, as follows:

"The following facts showing the relative yield and value of some of the chief agricultural products of Belgium will, at least, indicate how the matter of profit stands with the farmers in this country. The average yield of wheat per hectare (2.47 acres) is 1,675 kilograms (about 24 34-60ths bushels per acre); of rye, 1,460 kilograms (about 21 25-60ths bushels per acre); of barley, 1,830 kilograms (about 28 42-56ths bushels per acre); of oats, 1,500 kilograms

(about 38 00-40ths bushels per acre); of beets, washed and cleaned, ready for the refinery, 35,000 kilograms (about 15 856-2000ths tons). The average price of wheat is 28.50 francs per 100 kilograms (equal to about \$1.50 per bushel of 60 lbs.); of rye, 23 francs (about \$1.21 per bushel of 60 lbs.); of barley, 21 francs (about \$1.03 per bushel of 56 lbs.); of oats, 19.80 francs (about 56 cents per bushel of 40 lbs.); and of beets, from 20 to 25 francs per ton of 2,204 lbs. (equal to about \$3.50 to \$4.38 per ton of 2000 lbs.). The estimate will give, per hectare, the following cash values of these respective crops, viz.: Wheat, 477 francs (equal per acre, about \$36.82); rye, 433 francs (equal per acre, about \$33.43); barley, 384 francs (equal per acre, about \$29.64); oats, 315 francs (equal per acre, about \$24.32); and beets, about 800 francs (equal per acre, about \$60.76). Thus it will be seen that a hectare of beets will yield a cash value of 322 francs more than wheat, 367 more than rye, 416 more than barley, and 484 more than oats. I am not able to give the exact proportionate cost of the cultivation of these crops in this country, but it may be accepted as a fact that the cultivation of the beet crop does not, by any means, involve an increased expenditure of money equal to the increased value of the crop raised over that of any of the cereals just named."

Since the date of above report, there has been an enormous decline in the prices of all grains. Wheat, which averaged in Belgium, up to 1884, \$1.50 per bushel, is now selling under 70 cents, and the decline in rye has been even greater. It is not surprising that, throughout all Europe, there is a strong disposition to extend beet cultivation in every direction.

It appears from the above report of Mr. Wilson, that the farmers in Belgium found a greater profit in raising sugar beets for sale at \$3.50 to \$4.38 per ton than they realized from raising wheat at \$1.50, rye at \$1.21, barley \$1.03, and oats at 56 cents per bushel. With wheat selling in Canada at under 60 cents per bushel, barley about 40 cents, oats 30 cents, Canadian farmers must see how greatly it would conduce to their benefit if sugar beet factories were established in several localities, and would thus establish a market for a crop which has done so much for the farmers of many countries in Europe.

The *Popular Science Monthly* quoted, from Mr. A. H. Almy's book on Beet Sugar Industry, a statement that the profit obtained in Europe from the beet crop was three times greater than from wheat, barley or other grain crop.

BENEFICIAL EFFECTS OF BEET CULTIVATION ON AGRICULTURE.

Mr. George E. Bullock, United States Consul at Cologne, in a report dated June 1, 1881, says:—

“Beet root culture, as practised in Germany, does not in the least affect the yield of other products, for the thorough cultivation which it requires increases the fertility of the soil and does not exhaust its mineral constituents. The sugar is drawn from the atmosphere, and the richer the beet is in sugar, the less mineral substance it contains.”

Mr. John B. Hawes, United States Commercial Agent at Reichenberg, Austria, in a report dated November 8, 1889, says: “Raising beets improves the land, because the thorough cultivation necessary brings it to a perfection never to be attained with other crops. The land will also be cleared of weeds. In raising beets the whole agriculture of the country must be changed, brought from an extensive culture to an intensive one. In connection with the improvement of the land, cattle raising is also improved, as the waste furnishes excellent fodder for milk as well as for fattening. An increase of manure can therefore be produced.”

Mr. M. S. Brewer, United States Consul General at Berlin, in one of his reports, quotes from a book edited by L. Guttenburg—D. Collin:—“It is an established fact that notwithstanding the extensive cultivation of sugar beets, no decrease in the yield of cereals has taken place, but has, on the contrary, augmented by double and treble the amount in the districts where sugar beets are planted, and at these very places the production of meat is steadily increasing. The growth of sugar beets requires that the soil be tilled to a greater depth, thus adding to the thrift also of all other plants to be cultivated later on the same soil. Besides, the remnants or waste left in the manufacture of beet sugar furnishes not only an excellent food for cattle, but also a fertilizing stuff, dispensing to a considerable extent with the use of artificial manure. But the profit is also considerable which this industry affords people who work in the sugar factories, as they get employment throughout the whole year,—during the spring and summer seasons in the cultivation of the beets, and during the fall and winter in the manufactories.”

The New York Shipping and Commercial List has the following:

Mr. Leo Essich, who is thoroughly acquainted with the results in Europe and California, in a paper on "Sugar Beet Culture," says: "The immediate profits derived by farmers are not the only advantages they derive, but they obtain further advantage through the improvement of the soil, owing to its thorough cultivation when under beets." He shows that in the northern part of France, arrondissement Valenciennes, 353,000 hectolitres (about 1,012,000 bushels) was formerly the average wheat crop. After the beet industry was established, the wheat output increased to 428,000 hectolitres (1,215,000 bushels), although the wheat acreage had been reduced 25 to 30 per cent. Still more striking, however, was the increase of feed for stock. Where, previous to the beet growing, only 700 oxen were kept, there was afterwards plenty of food for 11,500 oxen.

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